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HARRY RAY BRYSON
1892-1956

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At the annual meeting of the Society held in Columbia, Missouri, on May 7, 1960, it was voted to honor Dr. Harry R. Bryson, former Professor of Entomology at Kansas State University, Manhattan, by using his photograph on the cover of the Journal for an indefinite period of time.

HARRY RAY BRYSON
1892-1956

It is most appropriate to put Professor Harry Bryson's picture on the cover of the Journal of the Kansas Entomological Society for many reasons but only a few can be given here. Born and educated in Kansas, he had successful careers as a high school and college teacher in Kansas; he gave of himself to his physical limits to help solve some of the most perplexing and difficult insect problems of the state, and he was a loyal, active member of the Central States Entomological Society from its founding until his death. His influence extended far beyond the use made of his publications through the many who studied under his direction. His students and his associates enjoyed his unfailing good humor, his devotion to duty and his genuine interest in entomology. His life and work were representative of the best in our science and profession.

For information about Professor Bryson's life, see his obituary [Jour. Econ. Ent. 50(2):229-230. 1957] and a partial list of his publications [Kans. State Coll. Bul. 21(9), p. 30, 1937].

ROGER C. SMITH

July 26, 1960

WINTER REARING OF SOUTHWESTERN CORN BORER LARVAE[1]

H. C. WALL AND W. H. WHITCOMB[2]

A method of rearing the southwestern corn borer, *Zeadiatrea grandiosella* (Dyar), during the winter would be extremely useful for insecticide experimentation, for testing of resistant varieties of corn, and for biological studies. The larvae normally go into diapause each fall and do not pupate until the following spring (Rolston, 1955). Until now, no method for preventing or breaking this diapause has been reported. Continuous off-season rearing has therefore not been possible.

On September 25, 1959, one hundred and fifty larvae in the third instar

[1] Published with the permission of the Director of the Arkansas Agricultural Experiment Station.

[2] Research Assistant and Entomologist, respectively, University of Arkansas.

were brought in from semi-mature corn in Independence County and placed in whorls of two-foot high corn in the greenhouse. Thirteen of these larvae pupated instead of entering diapause. The moths obtained from these pupae laid approximately 300 eggs. Larvae hatched from the eggs were again placed in whorls of two-foot high corn. They pupated, and the moths emerged. Eggs from these moths were laid in ample numbers and began a second generation. No further winter rearing problems presented themselves. Egg incubation averaged five days, larval stage 20 days, and pupal period 12 days—approximately the same as reported by Rolston (1955) for summer conditions. The temperature of the greenhouse was maintained between 70 and 80 degrees.

A cotton cloth cage 26 inches square and 36 inches high served as an oviposition cage. Strips of wax paper three inches wide hanging from the cage top gave ample opportunity for egg deposition. Eggs were hatched in petri dishes containing fresh corn leaves. Second instar larvae were placed in the whorls of corn plants where they fed, entered the stalks, and finally pupated.

Artificial lights were arranged to turn on automatically at 5 p.m. and off at 10 p.m., giving at least 14 hours of light. A combination of five 300-watt incandescent bulbs, 4 cool white fluorescent lamps of 40 watts each, 2 daylight fluorescent lamps of 40 watts each, and 2 black light fluorescent lamps of 40 watts each was used. At least 300 potted corn plants were maintained at all times.

Sufficient numbers of larvae for any desired studies were obtained almost at will. Staggering of generations was not attempted but could have been easily accomplished.

The availability of succulent corn at all times was an important part of the technique. Isely (1935) and other authors point out the role of food in preventing diapause. In the authors' experience a combination of artificial lights was also definitely necessary.

LITERATURE CITED

Isely, D. 1935. Variations in the seasonal history of the Colorado potato beetle. Jour. Kansas Ent. Soc., 8:142-145.

Rolston, L. H. 1955. The southwestern corn borer in Arkansas. Ark. Agric. Expt. Sta. Bull. 533:1-40.

A STUDY OF THE GENUS *MICRONECTA* OF INDIA, JAPAN, TAIWAN AND ADJACENT REGIONS

(Heteroptera: Corixidae)[1]

Ling-Chu Chen

INTRODUCTION

This paper summarizes the previous knowledge concerning the genus *Micronecta* Kirkaldy in the area indicated by the title, discusses morphological variation within species, redescribes the types of certain species originally described by Matsumura, describes eight new species from India, Japan, Taiwan and Ceylon, and notes certain instances of synonymy. The genus *Micronecta* has been well reviewed for some regions but the species of eastern Asia have been long neglected. Therefore, a key to the species in this genus of India, Japan and Taiwan is given.

Most early descriptions of *Micronecta* dealt largely with coloration of the hemelytra and relative sizes of major parts of the body such as the pronotum. Both these and other characters have been found highly variable within a given species. A few earlier authors misinterpreted this polymorphic variation, recognizing the various forms as full species or subspecies.

The material for the present study was made available to me by courtesy of the Francis Huntington Snow Entomological Museum of The University of Kansas, the National Taiwan University, and friends. I am especially indebted to Dr. H. B. Hungerford, who has assembled for the Snow Entomological Museum most of the oriental types from the collections of Dr. G. E. Hutchinson and Dr. S. Matsumura. Without these specimens for comparison, this work would not have been possible.

I wish to express my appreciation to all who have assisted me in this study and in the preparation of this paper, in particular to Dr. Hungerford and to Dr. G. W. Byers.

INDIVIDUAL VARIATION WITHIN SPECIES

There is a remarkable degree of individual variation within all species, particularly those having both brachypterous and macropterous forms. In these different forms, the relative dimensions of the head, pronotum and hemelytra vary according to the development of the hind wings; the size and shape of the pronotal disk, for example, are apparently correlated with the degree of tapering of the caudal ends of the hemelytra and the extent of development of the hind wings (Pl. II, Figs. 1-3, 5-10). Individuals of the same species from different localities often show conspicuous differences

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[1] Contribution number 1092 from the Department of Entomology, The University of Kansas. This paper comprises part of a thesis submitted in 1959 to the Department of Entomology of The University of Kansas, in partial fulfillment of the requirements for the degree of Master of Arts.

This study was made possible by a grant from the National Science Foundation to The University of Kansas.

in size and color; however, those from the same locality are usually quite uniform.

I have studied an extensive collection of *Micronecta formosana* Matsumura from Taiwan, with the results shown in Table I.

Table I, Results of Examinations of Polymorphic Forms of *Micronecta formosana* Matsumura

Collection data	Brachypterous form I	Brachypterous form II	Macropterous form
Formosa, Heito May, 1943 L. Gressitt	0	0	240(♂ & ♀)
Taiwan, Taipei Oct., 1956 L. C. Chen	44(♂ & ♀)	4(♂ & ♀)	19(♂ & ♀)
Taiwan, Taipei Jan., 1957 L. C. Chen	37(♂ & ♀)	9(♂ & ♀)	3(♂ & ♀)
Taiwan, Taipei Aug., 1957 L. C. Chen	96(♂ & ♀)	4(♀)	6(♂ & ♀)
Taiwan, Toyen Sept., 1957 L. C. Chen	69(♂ & ♀)	2(♂)	33(♂ & ♀)

The general aspects of this polymorphism are summarized below:

MACROPTEROUS FORM:

Length: 2.78 mm.

Head shorter than pronotum (Pl. II, fig. 1); caudal end of hemelytron rounded as Pl. II, fig. 5; hind wings (Pl. II, fig. 6) slightly exceeding abdomen. Pattern of coloration of hemelytron as Pl. I; shape of parameres as Pl. II, figs. 12-13.

BRACHYPTEROUS FORM I:

Length: 2.90 mm.

Head almost as long as pronotum (Pl. II, fig. 2); caudal end of hemelytron narrower than in macropterous form, as Pl. II, fig. 7; hind wing (Pl. II, fig. 8) extending to seventh abdominal tergite. Pattern of coloration of hemelytra and structure of parameres as in the macropterous form.

BRACHYPTEROUS FORM II:

Length: 2.55 mm.

Head slightly longer than pronotum (Pl. II, fig. 3); caudal end of hemelytron (Pl. II, fig. 9) narrowest of all three forms; hind wing (Pl. II, fig. 10) extending to sixth abdominal segment. Other characteristics as in above forms.

According to Table I, many individuals of the intermediate form (brachypterous I) possess characters of both the macropterous and brachy-

pterous II varieties. This suggests that the populations of brachypterous and macropterous forms can freely interbreed in the places where they occur together and that they are not reproductively isolated. Brachypterous and macropterous forms are known to occur in some other Hemiptera, partly as a result of genetic polymorphism. In another case, three different polymorphic forms from Java were incorrectly considered to be three different species. (*Micronecta ludibunda* Breddin, *M. inconspicua* Lundblad, and *M. striatella* Lundblad). Besides those characters that vary polymorphically, there are other characters in every species that are less subject to individual variation, such as coloration of the hemelytra in both sexes and structure of the male genitalia. In view of these similarities within species, no specific separation on the basis of wing polymorphism appears to be justified. Furthermore, the presence of intergrading forms, found to some extent among individuals from the same locality and more particularly among series from different localities, appears to make the establishment of subspecific forms impractical.

The brachypterous form of *Micronecta* shows, in addition to the polymorphism described, a structural adaptation to life in flowing water or to active movement through non-flowing water. This specialized form has an oval, streamlined shape, as water flows around it so smoothly that resistance is reduced to a minimum. In contrast to this, the relatively primitive macropterous form has the sides sub-parallel in the mid-region and has an elongate, flattened body. Usually, the brachypterous form of *Micronecta* occurs much more commonly than the macropterous form. For example, Lundblad (1933) reported that while more than a thousand individuals of the brachypterous form of *M. ludibunda* Breddin were found in Lake Ngebel, Java, all of uniform appearance, not other forms were present. Wróblewski (1958) states that in most Polish species of *Micronecta,* for example *M. meridionalis* (Costa), *M. minutissima* (Linnaeus), *M. poweri* (Douglas and Scott) and *M. carpatica* Wróblewski, the brachypterous forms are much more common than the macropterous forms.

Micronecta hungerfordi n. sp., from Taiwan, is here regarded as a specialized species because it is apparently represented chiefly by the brachypterous form. All available specimens (only about forty) of this species are brachypterous, with an oval body and certain other characteristics that are regarded as specialized, such as a transversely banded color pattern on the hemelytra (Pl. I), platelike left clasper (Pl. III, fig. 16), and inwardly pointed prestrigilar flap of the fifth abdominal tergite (Pl. III, fig. 19). This species may be compared to *M. thyesta* Distant, which shows many apparently primitive characters, including a flattened, elongate body, longitudinally striped hemelytra, left clasper with denticulate surface, and sixth abdominal tergite without a strigil. I have studied about two hundred specimens of *M. thyesta* Distant from several localities in Ceylon, India, Taiwan and Thailand but have never seen a brachypterous form. Perhaps the more specialized, brachypterous form has not yet evolved in this species.

The brachypterous form, as stated above, is regarded as having certain specialized adaptations to life in the water. One may hypothesize that if there is selection for one of various polymorphic forms of a species, that

form will increase in relative abundance in successive generations because of its better adaptation to the environment. If this hypothesis is true, and if one may judge from the relative abundance of brachypterous and macropterous forms of the species of *Micronecta,* then it appears that the brachypterous form is the more successful and is the more specialized of the two, and it may be regarded as the result of evolutionary adaptation.

KEY TO SPECIES OF INDIA, JAPAN AND TAIWAN, BASED ON MALES

1. Strigil present; distal margin of free lobe of eighth abdominal tergite not deeply emarginate 2
   Strigil absent; distal margin of free lobe of eighth abdominal tergite deeply emarginate ..... *M. thyesta* Distant
2. Fore tibia and tarsus of male fused into a tibiotarsus .... *M. issa* Distant[2]
   Fore tibia and tarsus of male not fused together 3
3. Anterior flexor hair row of pala with distal hair greatly thickened, forming a subsidiary claw-like structure 4
   Anterior flexor hair row of pala uniform throughout 5
4. Over 2.5 mm., posterior margin of pronotum in front of scutellum somewhat straight ..... *M. waltoniana* Hutchinson
   Under 2.5 mm., posterior margin of pronotum evenly rounded ..... *M. khasiensis* Hutchinson
5. Palar claw of foreleg wide apically; dorsal-basal lobe of left paramere absent 6
   Palar claw of foreleg elongate; dorsal and ventral basal lobes of left paramere both present 13
6. Color pattern of corium of hemelytra with many broad, irregular, dark bands 7
   Color pattern of corium of hemelytra with stripes or unicolorous throughout 8
7. Corium with basal, central and distal transverse bands; pronotum pale with two contrasting anterior, lateral, dark semicircular spots ..... *M. hungerfordi* n. sp.
   Corium only with central and distal transverse bands; pronotum dark with one contrasting anterior, central, light round spot ..... *M. japonica* n. sp.
8. Pronotum flat, its posterior margin almost straight .. *M. lenticularis* n. sp.
   Pronotum convex, its posterior margin evenly rounded 9
9. Submedian process of seventh abdominal sternite with right edge irregularly undulate (Pl. III, fig. 5); fore tibia more than 1.5 times as long as fore tarsus ..... *M. guttata* Matsumura
   Submedian process of seventh abdominal sternite with right and left sides similar; fore tibia less than 1.5 times as long as fore tarsus 10
10. In macropterous form, head about half as long as pronotum, parameres as in illustration (Pl. III, figs. 11-12) ..... *M. yui* n. sp.

[2] Placement based on the previous descriptions and drawings; I have not seen actual specimens.

Head of macropterous form shorter, much less than half as long as pronotum 11

11. Pronotum moderately transverse, two and a half times as wide as long; dorsal margin of left paramere not deeply emarginate at base 12

Pronotum very transverse, three to three and a half times as wide as long; dorsal margin of left paramere deeply emarginate at base ..... *M. daedala* Distant[2]

12. Distal part of right paramere strongly sigmoid ..... *M. taipeiensis* n. sp.

Distal part of right paramere simply curved to apex ..... *M. wui* Lundblad[2]

13. Color pattern of hemelytra with unbroken longitudinal stripes 14

Color pattern of hemelytra with broken stripes or otherwise marked 17

14. Hemelytra with three longitudinal dark stripes, one running anterior-posteriorly through long axis of clavus ..... *M. eucosmeta* Hutchinson

Hemelytra with more than three longitudinal stripes, none continuing onto clavus 15

15. Pronotum with solid transverse stripes 16

Pronotum without solid transverse stripes .... *M. albifrons* (Motschoulsky

16. Clavus with two stripes ..... *M. siva* (Kirkaldy)

Clavus with three stripes ..... *M. fascioclavus* n. sp.

17. Hemelytra marked distinctly with dark punctae 18

Hemelytra marked with broken longitudinal stripes or otherwise marked 19

18. Pronotum and hemelytra thickly sprinkled with punctures; posterior margin of pronotum in front of scutellum truncate ..... *M. punctinotum* n. sp.

Pronotum with marks unlike those of hemelytra; posterior margin of pronotum evenly rounded ..... *M. punctata* Fieber

19. Large species, over 3 mm. long ..... *M. scutellaris* Stål

Small or moderate species, under 3 mm. long 20

20. Palar claw of foreleg a simple, elongate lobe-like structure 21

Palar claw of foreleg having a subapical tooth ..... *M. tarsalis* n. sp.

21. Free lobe of eighth abdominal tergite right angulate, its distal end rounded and completely margined with bristle-like hairs ..... *M. quadristrigata* Breddin

Free lobe of eighth abdominal tergite more or less straight and subparallel sided, its distal end not round but with inner and outer angles, only the latter one bearing bristle-like hairs 22

22. Left paramere strongly sclerotized, narrow apically 23

Left paramere membranous, swollen distally 29

23. Distal part of left paramere distinctly denticulate 24

Distal part of left paramere smooth 27

24. Globular process of basal part of right paramere smooth 25

Globular process of basal part of right paramere with numerous ribs 26

25. Left paramere evenly pointed distally ..... *M. formosana* Matsumura
    Left paramere abruptly narrowed distally ..... *M. desertana* Distant
26. Left paramere with an apical triangular lobe ..... *M. sedula* Horvath
    Left paramere without an apical triangular lobe .....
    ..... *M. orientalis* Wróblewski
27. Right paramere evenly arcuate, distal half of shaft at no point wider than proximal half 28
    Right paramere broadened distally, distal half at least twice as wide as narrowest point in proximal half ..... *M. fulva* Paiva[2]
28. Left paramere slightly expanded at apex with a deep, simple cleft
    ..... *M. sanctae-catherinae* Hutchison
    Left paramere not expanded, twisted apically, with several irregular clefts ..... *M. substriata* Paiva[2]
29. Middle part of right paramere subparallel sided .....
    ..... *M. prashadana* Hutchinson
    Middle part of right paramere not subparallel sided .....
    ..... *M. flavens* Wróblewski

DESCRIPTIONS OF SPECIES[3]

Micronecta formosana Matsumura

Micronecta formosana Matsumura, 1915
Macropterous form (brachypterous form also known).
Size. Length 2.8 mm., width of head 0.9 mm.
Color. Varies from grayish yellow to brownish black above; head yellow; pronotum grayish brown, posterior margin paler; color pattern of hemelytra as shown in Pl. I; corium with four broken brownish longitudinal stripes, costal margins yellowish; venter dull grayish; legs yellowish.
Structural characteristics. Head shorter than pronotum; eye as wide as interocular spaces; pronotum about three times as wide as long, anterior margin arcuate; scutellum broad at base, apex acute; short spine-like setae scattered irregularly over corium and clavus. Proportions of median lengths of pronotum, scutellum, and distance from apex of scutellum to apex of clavus as 12:7:34[4]. Submedian process of seventh abdominal sternite (Pl. II, fig. 11) markedly prolonged; free lobe of eighth tergite as in illustration (Pl. II, fig. 14). Parameres as shown in Pl. II, figs. 12-13. Femur of foreleg (Pl. II, fig. 4) with a row of four spine-like setae on lower side; palar claw elongate.
Remarks. As a basis for redescription of this species, I have studied a large collection from the type locality and have also examined Matsumura's type specimens.

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[2] Placement based on the previous descriptions and drawings; I have not seen actual specimens.
[3] In cases where both the macropterous and brachypterous forms of a species have been examined, only the macropterous form is described here. The differences between brachypterous and macropterous individuals are, in general, the same for all species and have been discussed under the heading of Individual Variation Within Species.
[4] Unit of 1.0 = 0.25 mm.

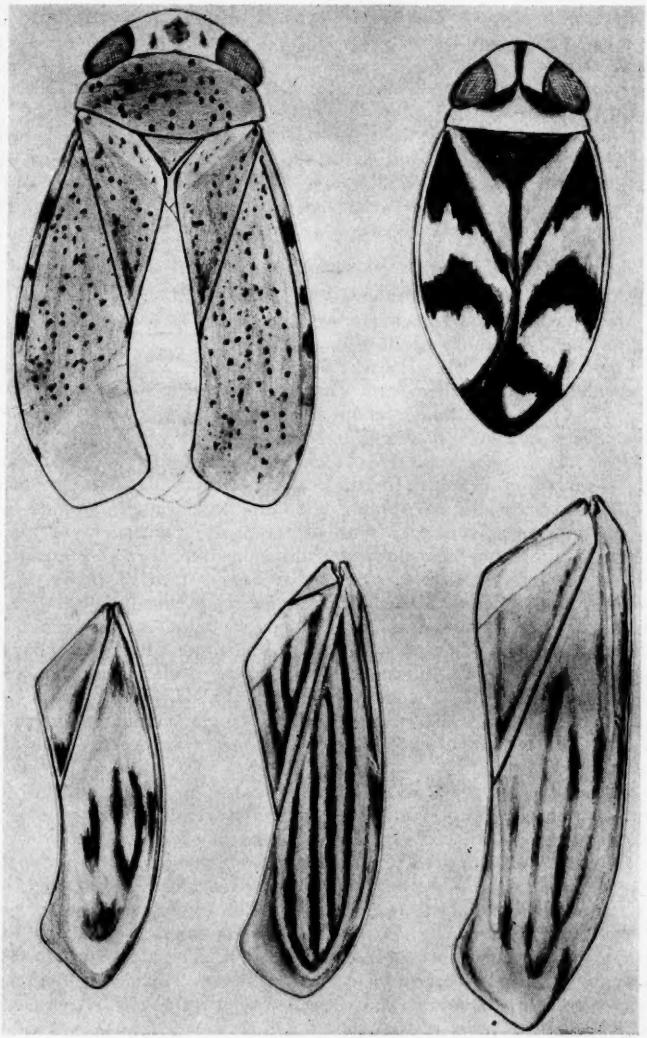

PLATE I. Upper left, *M. punctinotum* n. sp., dorsal aspect of holotype female. Upper right, *M. hungerfordi* n. sp., dorsal aspect of holotype male. Lower left, *M. taipeiensis* n. sp., right hemelytron. Lower middle, *M. fascioclavus* n. sp., right hemelytron. Lower right, *M. formosana* Matsumura, right hemelytron.

Comparative notes. This species belongs to the *scutellaris* group. The species of this group can be easily distinguished from each other by the genital structure of the male.

Holotype and allotype. Tainan, Taiwan, in Dr. Matsumura's collection, Japan.

Collection data. CHINA: TAIWAN—Taipei, 1956-57 (L. C. Chen); Heito, May, 1943 (L. Gressitt); Koshun, April, 1918 (J. Sonan); Taihoku, 1918 (J. Sonan); Heito, May, 1938 (Y. Miwa); Koshun, 1912 (H. Sauter); Amping, 1906 (H. Sauter); Takao, 1907 (H. Sauter); Taihoku, Aug., 1921 (R. Takahashi). KIANGSU—Soochow (Rem).

Micronecta guttata Matsumura

Micronecta guttata Matsumura, 1905

Macropterous form (brachypterous form unknown).

Size. Length 2 mm.; width of head 0.7 mm.

Color. General coloration dark; head yellow; pronotum brown, caudal edge paler; pattern of hemelytra similar to that of *Micronecta taipeiensis* n. sp. (Pl. I) but more faint. Ventral aspect of thorax yellowish, of abdomen darker; legs yellowish, darker distally.

Structural characteristics. Head narrower than pronotum, about half as long as pronotum; eye three-fourths as wide as interocular space; pronotum and hemelytra smooth and shining, the latter with scattered minute hairs, few in number as compared with other species. Proportions of median lengths of pronotum, scutellum, and distance from apex of scutellum to apex of clavus as 12:4:25. Prestrigilar flap as shown in Pl. II, fig. 4. Submedian process of seventh abdominal sternite broad basally (Pl. III, fig. 5), narrowing abruptly to a short, acute point, its right edge irregularly undulating; free lobe of eighth tergite as in illustration (Pl. III, fig. 3). Left clasper (Pl. III, fig. 1) differing from all others in the *minutissima* group in the shape of the distal end; right clasper (Pl. III, fig. 2) with a broad base, pointed apically and swollen near mid-length. Femur of foreleg (Pl. IV, fig. 16) with two spine-like setae on lower side; palar claw wide apically.

Remarks. The above redescription is based on two specimens from Sendai, Honshu, Japan, which were determined by Dr. Matsumura, and on the type specimens, which I have also examined.

Comparative notes. This species belongs to the *minutissima* group. The color pattern of the hemelytra in this group usually is reduced or weak, the maculations tending to fuse. Differentiation of females of some species in this group is extremely difficult or at present impossible, but the males exhibit definite and constant specific characters. The species can be easily distinguished by the shape of the male parameres. An idea of the specific differences in the parameres may be obtained more clearly by reference to Plate III than by a verbal description of them.

Holotype and allotype. Originally described from Tokyo (Honshu) and Kumanoto (Kyushu), Japan, collected by Matsumura. The type specimens are in Dr. Matsumura's collection, Japan.

Collection data. Only known to me by the type series and the two specimens from Sendai, deposited in the Hungarian National Museum.

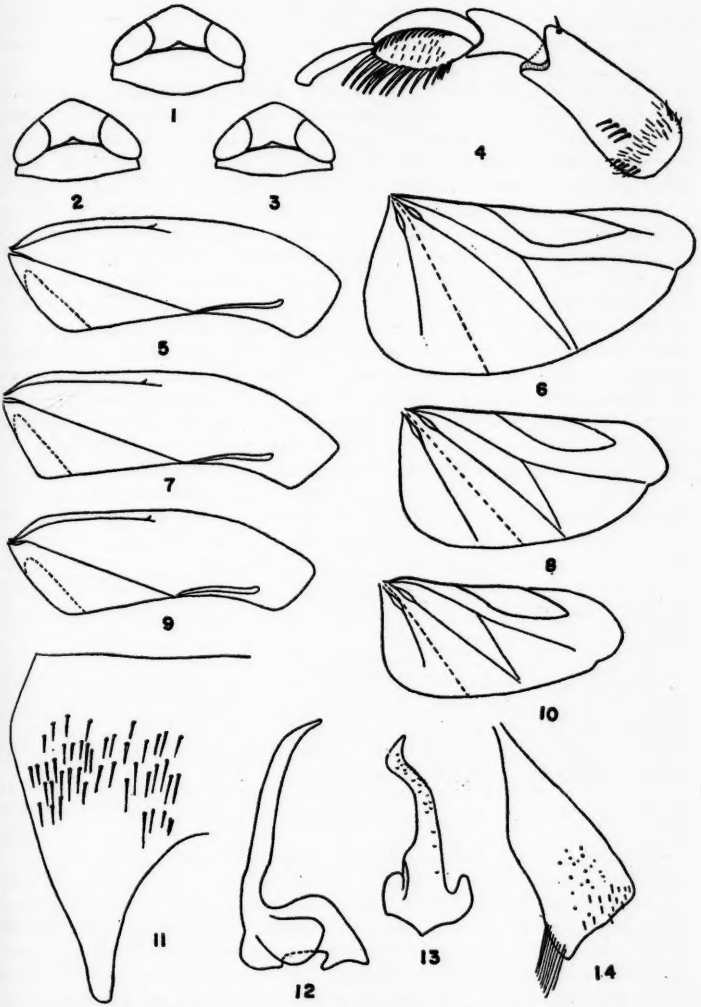

PLATE II. Figs. 1 to 14. *M. formosana* Matsumura. 1, head of macropterous form; 2, head of brachypterous form I; 3, head of brachypterous form II; 4, foreleg of male; 5, right hemelytron of macropterous form; 6, hind wing of macropterous form; 7, right hemelytron of brachypterous form I; 8, hind wing of brachypterous form I; 9, right hemelytron of brachypterous form II; 10, hind wing of brachypterous form II; 11, submedian process of seventh abdominal sternite, male; 12, right clasper; 13, left clasper; 14, free lobe of eighth abdominal tergite.

Micronecta fascioclavus n. sp.

Macropterous form (brachypterous form unknown).

Size. Length 2.5 mm.; width of head 0.87 mm.

Color. General coloration dark. Head yellowish white. Ground color of pronotum and hemelytra light brown in striking contrast with dark brown lineations (Pl. I), which are arranged as in *Micronecta siva* Kirkaldy, except clavus with three stripes instead of two, pronotum with three transverse and corium with four longitudinal stripes. Venter and legs dull gray.

Structural characteristics. Head shorter than pronotum; eye about four-fifths as wide as interocular distance; posterior margin of pronotum, in front of scutellum, almost straight. Hemelytra smooth, shining, with scattered pale hairs. Proportions of median lengths of pronotum, scutellum and distance from apex of scutellum to apex of clavus as 10:6:32. Prestrigilar flap as shown in Pl. IV., fig. 9. Seventh abdominal sternite with a pointed, subequilateral submedian process (Pl. IV, fig. 10); outer angle of free lobe of eighth tergite (Pl. IV, fig. 8) with a slight projection bearing a tuft of bristle-like setae. Right clasper (Pl. IV, fig. 6) simply curved and pointed to apex; left clasper (Pl. IV, fig. 7) with a broad base and elongate cylindrical middle part, bearing a leaf-like distal lobe. Femur of foreleg (Pl. IV, fig. 11) with a row of seven spine-like setae on lower side; palar claw elongate.

Comparative notes. The color pattern of this species closely resembles that of *Micronecta siva* Kirkaldy, from which it can be distinguished by the clavus of the hemelytra having three stripes instead of two. The genital structures of these two species are distinctly different from each other.

Holotype. Male, Chabua, Assam, India, June 14, (D. E. Hardy), in the Francis Huntington Snow Entomological Museum, The University of Kansas.

Allotype. Female, same data as for holotype.

Paratypes. Two females, taken with holotype; one male, four females, Colombo, Ceylon, Dec. 1910 (A. Luther); one male, two females, Colombo, Ceylon, Jan. 29 (year unknown) (Madarasz); one male, six females in the Francis Huntington Snow Entomological Museum and one male, two females, Hungarian National Museum.

Micronecta hungerfordi n. sp.

Brachypterous form (macropterous form unknown).

Size. Length 1.7 mm.; width of head 0.66 mm.

Color. Ground color of dorsum yellowish gray, mottled with distinct dark brown maculations; head with a central longitudinal stripe on the vertex; pronotal disk in some specimens with two obscure anterior, dark semicircular spots. Scutellum usually dark, together with the dark claval bases of the hemelytra forming a dull brownish V-shaped figure. Maculations (Pl. 1) of the basal angles, as well as at the central and distal parts of the hemelytra may have arisen from the fusion of longitudinal spots which are so common in this genus.

Structural characteristics. Head shorter than pronotum; eye narrow than interocular space; pronotum about three times as wide as long, anterior margin angulated, rather straight at the posterior margin. Hemelytra

smooth, shining, with numerous minute hairs. Proportions of median lengths of pronotum, scutellum, and distance from apex of scutellum to apex of clavus as 8:3:24. Wings reduced, hardly extending to middle of sixth abdominal tergite. Prestrigilar flap as shown in Pl. III, fig. 19. Submedian process of seventh abdominal sternite (Pl. III, fig. 20) narrowed to a blunt point; free lobe of eighth tergite (Pl. III, fig. 18) elongate and rounded, slightly different in shape from that of *Micronecta taipeiensis* n. sp. Claspers as in illustrations (Pl. III, figs. 16-17). Foreleg (Pl. IV, fig. 17) usually showing characters of the *minutissima* group.

Comparative notes. This little species has a very characteristic and beautiful color pattern, which will easily distinguish it from other species of the *minutissima* group.

Holotype. Male, Taipei, Taiwan, China, Aug. 1957 (L. C. Chen) in the Entomological Collection of National Taiwan University.

Allotype. Female, data same as for holotype.

Paratypes. Twelve males, four females with data as above; one male, three females, Sankakuyu, Taipei, Taiwan, April 1917 (J. Sonan); six males, six females, Taihoku, Formosa, Feb. 1941 (S. Miyamoto). Six males, four females in the Entomological Collection of National Taiwan University; and thirteen males, nine females in the Francis Huntington Snow Entomological Museum of The University of Kansas.

Micronecta japonica n. sp.

Macropterous form (brachypterous form also known).

Size. Length 1.62 mm., width of head 0.62 mm.

Color. General coloration resembling that of *M. hungerfordi* n. sp. Head grayish yellow, usually with a faint central brownish yellow spot on vertex; median posterior margin of vertex bearing a dark tubercle; pronotal disk dark brown contrasting with an anterior, central, yellowish white spot; scutellum dark, together with the dark claval bases of hemelytra forming a dull brownish V-shaped figure. Ground color of corium pale yellowish, mottled with distinct brown central and distal transverse broad bands. Membrane of left hemelytron suffused with brown, darkest along outer edge and line of attachment, where brown color blends into distal band of corium.

Structural characteristics. Head rounded anteriorly; interocular space distinctly greater than width of an eye; pronotum evenly rounded posteriorly, its greatest length about twice as long as head. Hemelytra smooth, shining, with numerous minute hairs. Proportions of median length of pronotum, scutellum, and distance from apex of scutellum to apex of clavus as 11:3:23. No submarginal bristles on right side of fifth abdominal tergite (as in most species of the *minutissima* group); tergite and prestrigilar flap are shown in Pl. III, fig. 9. Seventh abdominal sternite with a pointed subequilateral, submedian lobe (Pl. III, fig. 10). Free lobe of eighth tergite as Pl. III, fig. 8. Left clasper (Pl. III, fig. 6) with a broad base, parallel-sided free portion, rounded apically; right clasper as Pl. III, fig. 7.

Comparative notes. See this heading under *Micronecta hungerfordi* n. sp.

Holotype. Male, Kasari-mura, Amani-Ôshima, Japan, Aug. 18, 1954

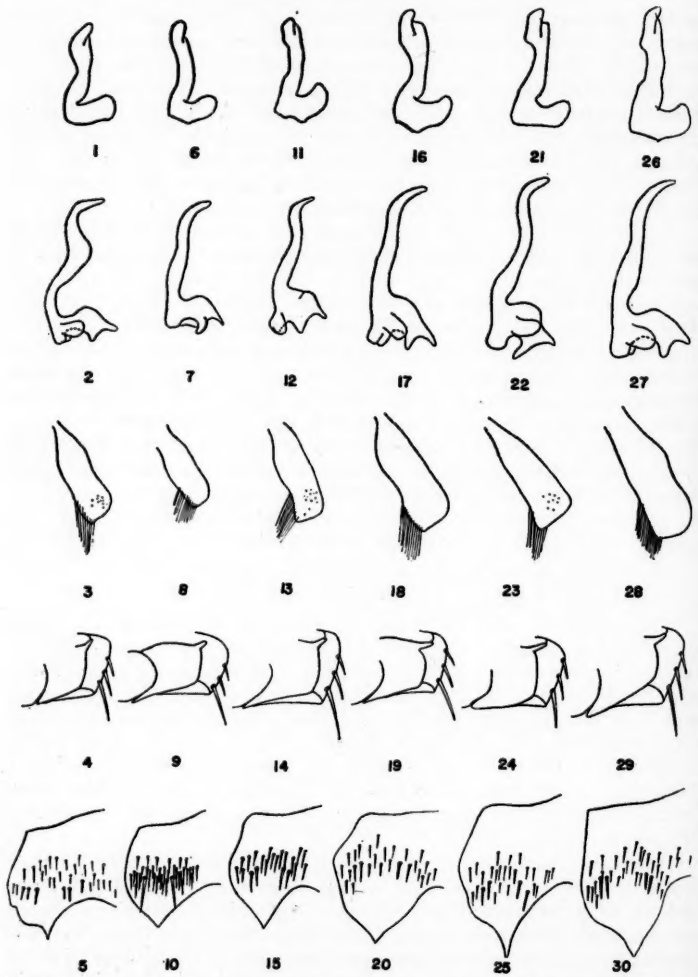

PLATE III. Fig. 1 to 5. *M. guttata* Matsumura. 1, left clasper; 2, right clasper; 3, free lobe of eighth abdominal tergite; 4, right side of fifth abdominal tergite; 5, submedian process of seventh abdominal sternite. Figs. 6 to 10. *M. japonica* n. sp. 6, left clasper; 7, right clasper; 8, free lobe of eighth abdominal tergite; 9, right side of fifth abdominal tergite; 10, submedian process of seventh abdominal sternite. Figs. 11 to 15. *M. yui* n. sp. 11, left clasper; 12, right clasper; 13, free lobe of eighth abdominal tergite; 14, right side of fifth abdominal tergite; 15, submedian process of seventh abdominal sternite; Figs. 16 to 20. *M. hungerfordi* n. sp. 16, left clasper; 17, right clasper; 18, free lobe of eighth abdominal tergite; 19, right side of fifth abdominal tergite; 20, submedian

(S. Miyamoto), in the Francis Huntington Snow Entomological Museum of The University of Kansas.

Allotype. Female, same data as for holotype.

Paratypes. Two males, three females with data as above, in the Francis Huntington Snow Entomological Museum of The University of Kansas.

Micronecta lenticularis n. sp.

Brachypterous form (macropterous form unknown).

Size. Length 1.7 mm.; width of head 0.65 mm.

Color. Rather uniformly yellowish brown; head with a central longitudinal stripe on vertex, usually the dark pattern of hemelytra as in *M. taipeiensis* n. sp., but maculations of central part of corium tend to be shortened and thickened, and the ends are not joined together. Venter and legs usually yellow.

Structural characteristics. Body as seen from above lenticular in shape. Head shorter than pronotum; eye about three fourths as wide as interocular space; pronotum flattened, lateral margins distinct though very short, anterior margin arcuate and posterior margin somewhat straight. Hemelytra, as is the rule in all brachypterous forms, tapering toward membranous area; clavus and corium with minute setae scattered throughout. Proportions of median lengths of pronotum, scutellum, and distance from apex of scutellum to apex of clavus as 8:5:25. Wings reduced, extending to end of fifth abdominal tergite. Prestrigilar flap as shown in Pl. III, fig. 29. Seventh abdominal sternite with a subequilateral submedian lobe (Pl. III, fig. 30); free lobe of eighth tergite as in illustration (Pl. III, fig. 28). Left clasper (Pl. 111, fig. 26) with a broad base, parallel-sided middle part and a finger-shaped expanded apex; right clasper (Pl. III, fig. 27) simply bent distally. Foreleg as in illustration (Pl. IV, fig. 14).

Comparative notes. See this heading under *Micronecta guttata* Matsumura.

Holotype. Male, Sankakuyu, Taipei, Taiwan, April 1, 1914 (J. Sonan) in the Entomological Collection of National Taiwan University.

Allotype. Female, same data as holotype.

Paratypes. Six males, sixteen females with data as above, and one male, one female, Urai, Taipei, Taiwan, April 3, 1917 (J. Sonan); three males, five females, Taihoku, Formosa, Feb. 1941 (S. Miyamoto). Three males, eight females in the Entomological Collection of National Taiwan University and seven males, fourteen females in the Francis Huntington Snow Entomological Museum of The University of Kansas.

Micronecta punctinotum n. sp.

Macropterous form (brachypterous form unknown).

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process of seventh abdominal sternite. Figs. 21 to 25. *M. taipeiensis* n. sp. 21, left clasper; 22, right clasper; 23, free lobe of eighth abdominal tergite; 24, right side of fifth abdominal tergite; 25, submedian process of seventh abdominal sternite. Figs. 26 to 30. *M. lenticularis* n. sp. 26, left clasper; 27, right clasper; 28, free lobe of eighth abdominal tergite; 29, right side of fifth abdominal tergite; 30, submedian process of seventh abdominal sternite.

Size. Length 2.3 mm.; width of head 0.8 mm.

Color. Head yellowish with a very obscure brown spot on center of vertex, and two elongate spots, one on either side; pronotum and hemelytra (Pl. I) with pale brownish background, thickly sprinkled with brownish black punctures; each lateral margin of hemelytron with four distinct dark spots. Ventral aspect of thorax and abdomen yellowish, lightly suffused with gray. Legs uniformly yellowish, slightly darker on tarsi.

Structural characteristics. Head little produced anteriorly, margin of the vertex almost following curve of eye; posterior margin of vertex with a minute tubercle; eye about three-fifths as wide as interocular space; pronotum about two and a half times wider than median length and one and a half times longer than head, posterior margin in front of base of scutellum somewhat truncate, narrowed at ends. Scutellum about one and a half times wider at base than length. Hemelytra exceeding abdomen slightly; membranous area of left hemelytron transparent; minute peg-like setae scattered irregularly over clavus and corium. Proportions of median lengths of pronotum, scutellum, and distance from apex of scutellum to apex of clavus as 15:7:29. Wings well developed.

This species is described from a single female. Therefore, the male characteristics cannot be taken into consideration.

Comparative notes. This species is easily recognized by the color pattern, as shown on Plate I. It is close to the macropterous form of *M. punctata* Fieber in general appearance but differs from that species especially in having punctations on the pronotum as well as on the hemelytra and also in the shape of the pronotum.

Holotype. Female, Chabua, Assam, India, Oct. 2, 1943 (D. E. Hardy), in the Francis Huntington Snow Entomological Museum of The University of Kansas.

Micronecta taipeiensis n. sp.

Macropterous form (brachypterous form also known).

Size. Length 2.2 mm.; width of head 0.7 mm.

Color. General coloration yellowish brown above and pale yellow below. Head grayish yellow, median posterior margin of vertex bearing a dark tubercle; color pattern of pronotum varies, sometimes with one of two spots on either side or with the color uniform throughout. Each hemelytron (Pl. I) with a semi-transparent anterior margin on clavus, forming a V-shaped figure bordering scutellum; center of corium with four dark stripes, of which the ends of the middle two usually join together.

Structural characteristics. Head slightly narrower and one-half as long as pronotal disk; interocular space distinctly greater than width of an eye; pronotal disk convex, lenticular in outline, evenly rounded posteriorly. Hemelytra smooth, shining, with numerous minute hairs. Proportions of median lengths of pronotum, scutellum, and distance from apex of scutellum to apex of clavus as 14:5:25. Prestrigilar flap as shown in Pl. III, fig. 24. Seventh abdominal sternite as in illustration (Pl. III, fig. 25); free lobe of eighth tergite (Pl. III, fig. 23) with inner and outer angles both rounded, truncate distally; claspers as shown in Pl. III, figs. 21-22. Foreleg (Pl. IV,

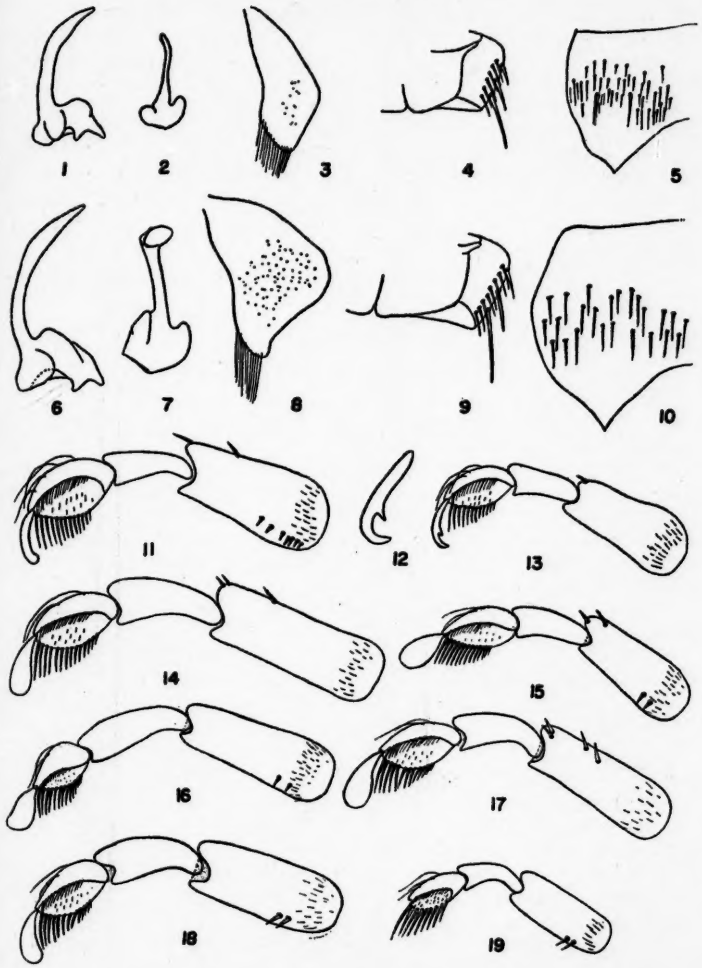

PLATE IV. Rigs. 1 to 5. *M. tarsalis* n. sp. 1, right clasper; 2, left clasper; 3, free lobe of eighth abdominal tergite; 4, right side of fifth abdominal tergite; 5, submedian process of seventh abdominal sternite. Figs. 6 to 10. *M. fascioclavus* n. sp. 6, right clasper; 7, left clasper; 8, free lobe of eighth abdominal tergite; 9, right side of fifth abdominal tergite; 10, submedian process of seventh abdominal sternite; 11, foreleg, male. Figs. 12 to 13. *M. tarsalis* n. sp. 12, palar claw of foreleg, male; 13, foreleg, male. Figs. 14 to 19. Forelegs of male. 14, *M. lenticularis* n. sp.; 15, *M. yui* n. sp.; 16, *M. guttata* Matsumura; 17, *M. hungerfordi* n. sp. 18, *M. taipeiensis* n .sp.; 19, *M. japonica* n. sp.

fig. 18) long and slender, femur with two spine-like setae on lower side; palar claw wide apically.

Comparative notes. See this heading under *Micronecta guttata* Matsumura.

Holotype. Male, Taipei, Taiwan, China, July 1957 (L. C. Chen), in the Entomological Museum, National Taiwan University.

Allotype. Female, same data as holotype.

Paratypes. CHINA, TAIWAN: 24 males and females with data as above; 48 males and females, Sankakuyu, Taipei, April 1917 (J. Sonan); one male, Urai, Taipei, Sept. 1921 (J. Sonan); one female, Arisan, Oct. 1918 (J. Sonan). Paratypes equally divided between the Entomological Collection of National Taiwan University and the Francis Huntington Snow Entomological Museum of The University of Kansas.

Micronecta tarsalis n. sp.

Macropterous form (brachypterous form unknown).

Size. Length 1.8 mm.; width of head 0.6 mm.

Color. General coloration yellowish brown. Head whitish with an obscure orange longitudinal stripe on center of vertex and two lateral small spots, one close to each eye. Color pattern of hemelytra similar to but less contrastingly marked than that of *Micronecta formosana* Matsumura; stripes on corium somewhat faint. Ventral surface yellowish.

Structural characteristics. Median posterior margin of vertex of head elevated into tubercle; head about half as long as pronotal disk; eye narrower than interocular space; vertex smoothly rounded, as seen from above; pronotum lenticular in outline. Hemelytra smooth, shining, with numerous scattered hairs. Proportions of median lengths of pronotum, scutellum, and distance from apex of scutellum to apex of clavus as 12:7:25. Prestrigilar flap as shown in Pl. IV, fig. 4. Submedian process of seventh abdominal sternite (Pl. IV, fig. 5) with posterior margin short and acute; free lobe of eighth tergite as in illustration (Pl. IV, fig. 3). Right clasper (Pl. IV, fig. 1) simply curved and pointed; left clasper (Pl. IV, fig. 2) with a flat, elongate, plate-like shaft. Palar claw of foreleg (Pl. IV, fig. 13) with a subapical tooth.

Comparative notes. This little species is closely allied to *Micronecta fugitans* Breddin, of which I have studied material from Thailand. However, it can be distinguished from *M. fugitans* by its palar claw having a subapical tooth and also by the different form of the left clasper.

Holotype. Male, Kandy, Ceylon (Madarasz), in the Hungarian National Museum.

Allotype. Female, same data as holotype.

Paratypes. One female with data as above, in the Francis Huntington Snow Entomological Museum of The University of Kansas.

Micronecta yui n. sp.

Macropterous form (brachypterous form also known).

Size. Length 1.9 mm.; width of head 0.65 mm.

Color. Varies from yellowish to dark brown; eyes dark; front and vertex yellowish gray. Pattern of hemelytra much as in *Micronecta taipeiensis*

(Pl. I), but the darker parts fainter, clearly visible in only a few specimens, pattern faded or hemelytra uniformly colored in most specimens.

Structural characteristics. Median posterior margin of vertex of head elevated into a tubercle; head narrower and shorter than pronotum; eye narrower than interocular space; posterior margins of eyes approximate to posterior margin of head. Anterior margin of pronotum angulated, posterior margin convex. Scutellum broad at base, narrowed abruptly beyond midlength, apex very acute. Hemelytra exceeding abdomen, short spine-like setae scattered irregularly over corium and clavus. Proportions of median lengths of pronotum, scutellum, and distance from apex of scutellum to apex of clavus as 10:4:18. Prestrigilar flap as shown in Pl. III, fig. 14. Submedian process of posterior margin of seventh abdominal sternite (Pl. III, fig. 15) similar to that of *M. hungerfordi* n. sp.; free lobe of eighth tergite (Pl. III, fig. 13) with well developed inner and outer rounded angles. Claspers as in illustrations (Pl. III, figs. 11-12). Femur of foreleg (Pl. IV, fig. 15) with two spine-like setae on upper side and two on lower side.

Comparative notes. See this heading under *Micronecta guttata* Matsumura.

Holotype. Male, Karenko, Taiwan, China, Sept. 1954 (F. Y. Yu), in the Entomological Museum, National Taiwan University.

Allotype. Female, same data as holotype.

Paratypes. Three hundred and ten males and females with data as above, and 250 males and females from the following localities: CHINA, TAIWAN: Takano, 1907 (H. Sauter); Taihoku, Aug. 9, 1921 (J. Sonan); Koshun, April, 1918 (J. Sonan et. al); Koshun, Sept. 1912 (H. Sauter); Heito, May 11, 1934 (L. Gressitt); Rokki, May 17, 1934 (L. Gressitt); Taihoku, Feb. 16, 1941 (S. Miyamoto). Half of males and females in the Entomological Collection of National Taiwan University and half in the Francis Huntington Snow Entomological Museum of The University of Kansas.

NOTES ON SYNONYMY

Micronecta ludibunda Breddin

Micronecta ludibunda Breddin, 1905.
Micronecta inconspicua Lundblad, 1933.
Micronecta striatella Lundblad, 1933.

In 1933, Lundblad proposed *Micronecta inconspicua* and *Micronecta striatella* as two species very closely related to *Micronecta ludibunda* Breddin. He based these two species mainly on the sizes of the head, pronotum and wings and the shapes of the caudal end of hemelytra and body. However, he mentioned in his paper that the genital structures of these three species are so similar that they are almost insufficient for separating them.

At that time, Dr. Lundblad might have been confused by the polymorphism of this genus, since all the above characters which he used for specific differentiation are now commonly considered to be highly variable within one species. Apparently the fully winged *Micronecta striatella* Lundblad is the macropterous form of *M. ludibunda* Breddin, the brachpterous *M. ludibunda* Breddin and *M. inconspicua* Lundblad are two different intergrading forms, as discussed previously in the case of *M. formosana*

Matsumura. I have examined a specimen of *M. ludibunda* Breddin which was identified by the original author and have also studied a large collection from Thailand including both macropterous and brachypterous forms. It is obvious to me that they all belong to the species *M. ludibunda* Breddin.

Micronecta albifrons (Motschoulsky)

Corixa albifrons Motschoulsky, 1863.
Sigara albifrons Kirkaldy, 1897.
Micronecta albifrons Bergroth, 1921, nec Kirkaldy, 1908.
Micronecta lucina Distant, 1910
Micronecta albifrons albifrons (Motschoulsky); Hutchinson, 1940.
Micronecta albifrons albifrons trans. ad *striatella* Lundblad, Hutchinson, 1940.
Micronecta albifrons striatella Lundblad; Hutchinson, 1940.

In 1940, Hutchinson regarded *Micronecta striatella* Lundblad (from Java) as a subspecies of *M. albifrons* (Motschoulsky), the typical subspecies *M. albifrons albifrons* (=*M. lucina* Distant) being from Colombo, Ceylon. At that time he considered specimens from Madras, India, and Burma as belonging to an intermediate race, *M. albifrons* trans. ad *striatella* Lundblad, between the above two subspecies. However, I believe Hutchinson incorrectly evaluated *M. striatella* Lundblad. It is distinctly a different species on the basis of comparison of either the color pattern of the clavus of the hemelytra or the structure of the genitalia, which characters I have studied in a collection from Thailand.

According to Dr. Hutchinson's (1940) description, *M. albifrons albifrons* has a short pronotum, four times as wide as long. A pronotum of such proportions is very close to that of the brachypterous form of *M. albifrons* from India, specimens of which in our collection measure 0.16 mm. in length of pronotum and 0.65 mm. in width. On the basis of this comparison the subspecies *M. albifrons albifrons* is considered here to be only a brachypterous form of *M. albifrons* (Motschoulsky).

The types of *M. albifrons albifrons* trans. ad *striatella* Lundblad are also in our collection. These two specimens, from Madras, India, show fully developed wings and have a longer pronotum, three times as wide as long. It seems to me there is no doubt that this intermediate race is actually a macropterous form of *M. albifrons*.

Micronecta daedala Distant

Micronecta daedala Distant 1910, Hutchinson, 1933.
Micronecta singhpruthii Lundblad, 1933.

Micronecta singhpruthii Lundblad, from Punjab, India, was considered by Hutchinson (1940) as a subspecies of *M. daedala* Distant from Bengal, India. Hutchinson stated that it was a poorly differentiated sub-species, differing primarily in having a longer head (one and a half times as long as the pronotum instead of one and a quarter times as long).

According to Hutchinson's and Lundblad's descriptions, drawings and photograph, the characters of *M. singhpruthii* Lundblad all agree with those

of a typical brachypterous *M. daedala* Distant. Unfortunately, I have not yet been able to examine these two forms.

Micronecta (Micronectella) thyesta Distant

Micronecta thyesta Distant, 1910.
Micronecta pillosella Matsumura, 1915.

Having access to Matsumura's types has been a great convenience in identifying species of *Micronecta* from Taiwan, since his short description agrees with almost every Taiwanese species.

Judging from the external appearance of the holotype and from a few preparations made from other specimens from Taipei, Taiwan, compared with Hutchinson's (1940) redescription and drawings of *Micronecta thyesta* Distant, *Micronecta pillosella* Matsumura is evidently a synonym of *Micronecta thyesta* Distant.

Micronecta punctata Fieber

Micronecta punctata Fieber, 1844.
Micronecta haliploides Horvath, 1904.
Micronecta inflatula Breddin, 1905.
Micronecta paradalina Breddin, 1905.
Micronecta merope Distant, 1910.

Micronecta inflatula Breddin and *Micronecta merope* Distant were stated by Lundblad (1933) to be conspecific with *Micronecta haliploides* Horvath, which is a brachypterous form. In the same paper, Lundblad regarded *Micronecta paradalina* Breddin as probably a synonym of *Micronecta punctata* Fieber. In the Snow Entomological Museum, there is a specimen of *M. paradalina* Breddin which was determined by the original author and which bears a label from the type series from Java. The characteristic color pattern of *paradalina,* when compared with the original description of *M. punctata* Fieber, agrees well with Fieber's description: "clavus and corium with scattered black punctate spots . . . head about as long as pronotum and about half as long as basal width between eyes." On the basis of this comparison, I believe they belong to the same species and are the macropterous form.

Among materials from Thailand and India I have found fifty specimens of the macropterous form (*M. punctata* Fieber) and fifteen of the brachypterous form (*M. haliploides* Horvath). As their characteristic color patterns are identical and the parameres of the males differ within the limits of intraspecific variation, there is little doubt that the five species named above actually belong to one species.

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EFFECT OF INSECTICIDAL SEED TREATMENTS ON RICE[1]

L. H. ROLSTON, PHIL ROUSE AND VERNON HALL[2]

Seedsmen and farmers have shown considerable interest in the treatment of seed rice with insecticides for control of rice water weevil (*Lissorhoptrus oryzophilus* Ksl.) and grape colaspis (*Colaspis flavida* Say). Insecticides known to be effective against rice water weevil are aldrin, chlordane, dieldrin, heptachlor, lindane and toxaphene (5). Of these, aldrin, dieldrin and lindane have been successfully used on an experimental basis as seed treatments (2, 3). Aldrin as a soil treatment (1, 4) and Thimet as a seed treatment are effective against grape colaspis larvae, but the latter insecticide gives relatively poor control of rice water weevil (4). Aldrin is the only insecticide currently known to control both rice water weevil and grape colaspis larvae as a seed treatment. The required dosage for control of both insects is ¼ pound per bushel of seed. Half this amount will control rice water weevil.

Various formulations of aldrin were tested for phytotoxicity to rice before recommending seed treatment as a general practice. The other insecticides that are effective against rice water weevil, except chlordane, and a few insecticides of unknown effectiveness against either pest, were investigated for phytotoxicity to rice as a preliminary to small plot work on control. Dosages were determined approximately by cost, or physical limitations, in the absence of biological evidence or manufacturer's recommendations to the contrary. Nine materials, including three formulations of aldrin, were tested in the laboratory for possible effect on germination and seedling vigor and in the field for possible effect on plant stand and yield. Four of these insecticides, plus another, were tested in the greenhouse.

METHODS

Wettable powders were stuck to the seed with a three per cent solution of methyl cellulose. Germination of Bluebonnet 50 was tested in the laboratory at 80° F. a few days after treatments were applied. This test was replicated eight times, a replication consisting of one hundred seeds. Seeds showing either root or plumule, however small, after three or four days in the germinator, were considered to have germinated successfully. As a measure of vigor, the length of plumules and roots were measured on ten seedlings taken at random from each replication.

Treatments were field tested under standard cultural practices in a randomized block experiment having three replications. Seed was drilled on May 24, approximately a month after treatments were applied. The seeding rate of each treatment was determined by counting the seeds in one square foot at ten locations in each replication. Stand counts were

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taken on June 10, using the same procedure. Counts of rice water weevil larvae at thirteen and twenty days after flooding were too low to evaluate the treatments. Yields were taken on 6 by 30 foot plots on September 23.

Zenith seed was treated as in the previous test, except for the addition of one-half ounce of Ceresan M per bushel to all treatments, and planted ten days later in the greenhouse. Eighteen seeds were planted in each of the four replications of the randomized block experiment. Germination was measured by the plant stand count two weeks after planting. The replicates were thinned to ten plants after three weeks and to four plants after six weeks. Plant height was measured at weekly intervals for seven weeks to determine the effect of treatments on plant growth. Yields were taken at maturity.

A portion of the seed treated for the greenhouse test was held at room temperature from June 19 to November 12. This seed was tested for germination by planting in flats in the greenhouse. Fifty seeds were planted in each of four replications and the plant stand taken eleven days later.

RESULTS

Germination was reduced in the laboratory test by aldrin 2 pound emulsifiable concentrate but not by the other insecticides or aldrin formulations. All treatments, except heptachlor 25 per cent wettable powder, reduced root and/or plumule length (Table 1). These criteria were not necessarily reliable indications of the results obtained when seeds were planted in soil.

TABLE 1. Effect of various insecticides and formulations as seed treatments on germination and seedling vigor of Bluebonnet 50 rice in the germinator.

Insecticide and Formulation	Lbs./Bu. Active	Percent Germination	Root Length mm.	Plumule Length mm.
Sevin 50 wp	¼	86.8	3**	4**
Lindane 25 wp	¼	89.4	4**	4**
Aldrin 2 ec	¼	82.1**	6**	4**
Toxaphene 40 wp	½	88.2	9**	6*
Di-syston 50 charcoal	½	86.8	9**	6*
Aldrin 25 wp	¼	87.2	10*	8
Aldrin 4 sol.	¼	89.9	11*	5**
Heptachlor 25 wp	¼	89.5	12	7
Check		90.0	15	8
Dieldrin 50 wp	¼	88.9	16	6*

*, ** Significantly different from check at the 5% or 1% levels respectively.

The treatments did not affect seeding rate or plant stand in the field to a degree that was measurable by the methods used (Table 2). However, the techniques were apparently too gross to measure other than very large differences. The lindane treatment was quite conspicuous in the field test. The rice in these plots was smaller and lighter in color than that in the other plots, plant stand was probably reduced, and grass became abundant. Yield was reduced by nearly half. The increased yield of the aldrin 4 pound solution treatment cannot be explained. Rice water weevil larval popula-

tions were very low and no other pests that could have influenced yield were observed.

TABLE 2. Effect of various insecticides and formulations as seed treatments on seeding rate, plant stand and yield of Bluebonnet 50 in the field.

Insecticide and Formulation	Lbs./Bu. Active	Seeds per Square Foot	Plants per Square Foot	Yield in Pounds
Lindane 25 wp	¼	42.7	12.0	9.6**
Aldrin 2 ec	¼	46.3	23.7	16.1
Di-syston 50 charcoal	½	54.0	26.7	17.5
Toxaphene 40 wp	½	35.3	25.0	17.7
Check		44.0	27.3	18.0
Sevin 50 wp	¼	47.7	20.0	18.7
Heptachlor 25 wp	¼	40.7	36.0	18.8
Aldrin 25 wp	¼	42.3	34.0	19.9
Dieldrin 50 wp	¼	43.3	28.3	19.9
Aldrin 4 sol.	¼	63.7	28.3	20.9*

*, ** Significantly different from check at the 5% or 1% levels respectively.

The insecticides tested in the greenhouse did not influence plant stand, rate of growth or yield (Table 3). After storage at room temperature for nearly five months, germination as measured by plant stand ranged from 53.0 to 70.5 per cent among the treatments. This difference was not statistically significant.

TABLE 3. Effect of various insecticidal seed treatments on plant stand, rate of growth and yield of Zenith rice in the greenhouse.

Treatment	Percent Plant Stand	Plant Height at Weekly Intervals in mm. 1	2	3	4	5	6	7	Yield Grams
Aldrin 75 wp	86.0	25	76	123	155	201	221	253	6.45
Dieldrin 75 wp	76.2	26	79	120	147	198	221	245	7.28
Heptachlor 25 wp	88.8	25	76	125	144	199	220	247	6.49
Sevin 50 wp	95.8	22	71	117	141	198	224	253	6.67
Thiodan 25 wp	86.0	25	76	120	144	197	217	246	6.29
Control (sticker)	92.8	25	79	126	150	202	224	248	6.12
Check	77.8	24	79	123	150	205	224	252	6.65

SUMMARY

Seed treatments of aldrin solution, emulsifiable concentrate and wettable powder formulations, and wettable powders of dieldrin, Di-syston, heptachlor, Sevin and toxaphene were tested in a germinator for their effect on germination and vigor of Bluebonnet 50 rice. All treatments except heptachlor measurably reduced germination or vigor. This did not prove to be a reliable indication of field results. Only lindane was sufficiently phytotoxic in the field to have practical implications. A greenhouse test of wettable powder seed treatments of aldrin, dieldrin, heptachlor, Sevin and Thiodan on Zenith rice did not indicate any reduction of plant stand, rate of growth or yield as a result of treatments. Storage at room temperatures for approximately five months caused no greater reduction of plant stand in the treatments than in the check.

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A NEW SPECIES OF *PHYSCONELLOIDES* (MALLOPHAGA) FROM TEXAS.

K. C. EMERSON
Stillwater, Oklahoma

A new chewing louse collected from the White-winged Dove in Texas is herewith described. Illustrations for all known species of the genus *Physconelloides* from North America (north of Mexico) are presented.

Physconelloides wisemani n. sp.

MALE. Ventral, anterior spine-like processes of forehead longer than in *P. zenaidurae;* but shorter than in *P. spenceri.* Lateral, preantennal spine-like processes as shown in figure 9. Chaetotaxy, except for terminal abdominal segments, as in *P. zenaidurae.* Chaetotaxy of genital region as shown in figure 14. The male genitalia do not appear to be distinctive.

FEMALE. Spine-like processes of the head as in the male. Chaetotaxy, except for terminal abdominal segments, as in *P. zenaidurae.* Chaetotaxy of vulva region as shown in figure 4.

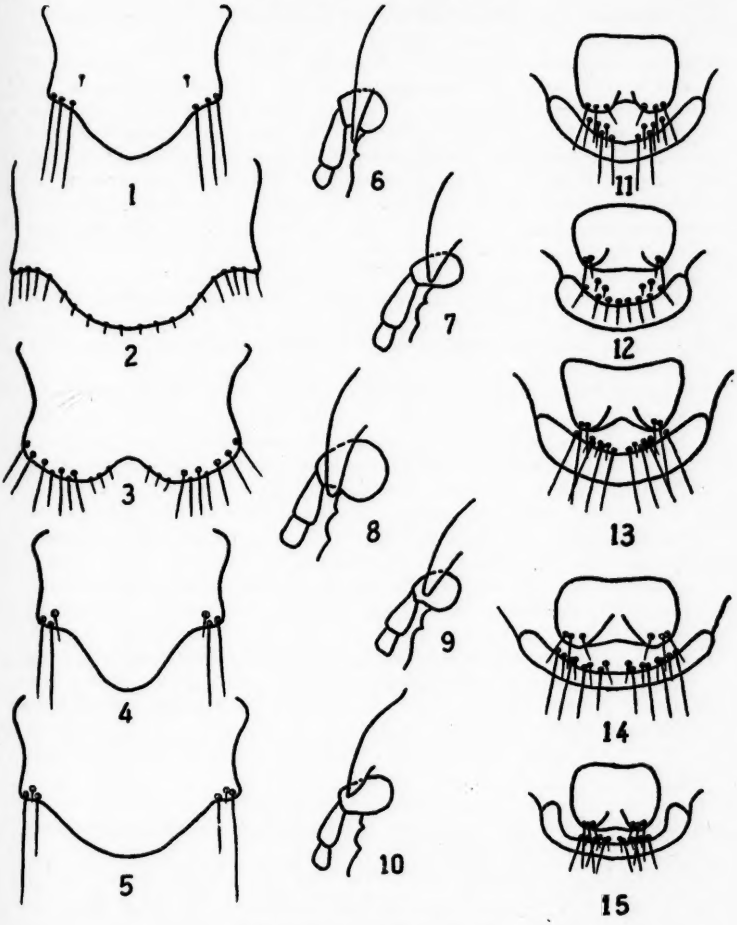
Measurements:

	Male	Female
Length of head	0.33 mm	0.33 mm
Width of head	0.52	0.53
Width of prothorax	0.30	0.30
Width of pterothorax	0.38	0.38
Width of abdomen	0.58	0.63
Total length	1.21	1.40

Type host: *Zenaida asiatica* (Linnaeus), White-winged Dove.

Type material: Holotype male, allotype female and seven paratypes collected in Hidalgo County, Texas, by Dr. John S. Wiseman on September 15, 1959. Five paratypes collected on Little Inagua Island, Bahama Islands, by H. S. Peters on August 5, 1930. One paratype collected at Harlingen, Texas, by E. W. Laake on November 22, 1921. The holotype and allotype have been deposited in the U. S. National Museum.

Discussion. Species of the genus *Physconelloides* are found on New World hosts of the avian order Columbiformes (pigeons and doves), the



EXPLANATIONS OF FIGURES

Figures 1-5. Vulval plate of female, *Physconelloides* species. Fig. 1. *P. ceratoceps* Ewing, Fig. 2. *P. spenceri* Emerson and Ward, Fig. 3, *P. passerinae* Emerson, Fig. 4. *P. wisemani* n. sp., Fig. 5. *P. zenaidurae* (McGregor). Figures 6-10. Lateral preantennal spine-like processes of male. Fig. 6. *P. ceratoceps* Ewing, Fig. 7. *P. spenceri* Emerson and Ward, Fig. 8. *P. passerinae* Emerson, Fig. 9. *P. wisemani* n. sp., Fig. 10. *P. zenaidurae* (McGregor). Figures 11-15. Genital region of male. Fig. 11. *P. ceratoceps* Ewing, Fig. 12. *P. spenceri* Emerson and Ward, Fig. 13. *P. passerinae* Emerson, Fig. 14. *P. wisemani* n. sp., Fig. 15. *P. zenaidurae* (McGregor). All figures drawn to the same scale.

only exception being that *P. zenaidurae,* normally found on the Mourning Dove, has occasionally been collected from the domestic pigeon. The external morpological characters which appear to be valid for separation of species are: the shape and chaetotaxy of the vulval plate of the female, the chaetotaxy of the genital region of the male, the lateral spine-like processes of the preantennal region, and size. These characters have been illustrated for the five species known to occur in North America (north of Mexico), since they can not be adequately described. *P. wisemani* is closest to *P. zenaidurae.* In addition to the differences apparent from a comparison of the illustrations, the male of *P. wisemani* is larger and the female is smaller than for *P. zenaidurae.*

North American species of *Physconelloides* and their hosts are:

P. ceratoceps Ewing, 1927, from *Leptotila verreauxi* Bonaparte, White-fronted Dove.

P. passerinae Emerson, 1957, from *Columbigallina passerina* (Linnaeus), Ground Dove.

P. spenceri Emerson and Ward, 1958, from *Columba fasciata* Say, Band-tailed Pigeon.

P. wisemani n. sp from *Zenaida asiatica* (Linnaeus), White-winged Dove.

P. zenaidurae (McGregor, 1917) from *Zenaidura macroura* (Linnaeus), Mourning Dove, and from domestic pigeon.

The Red-billed Pigeon, *Columba flavirostris* Wagler and the Inca Dove, *Scardafella inca* (Lesson), found along the southern border of the United States, probably also have parasites of this genus.

Other known species of the genus and their hosts and distribution are:

P. eurysema (*Carriker,* 1903) from *Claravis mondetoura* (Bonaparte), Costa Rica.

P. galapagensis (Kellogg and Kuwana, 1902) from *Nesopelia galapagoensis* (Gould), Galapagos Archipelago.

P. mattogrossensis (Guimarães, 1936) from *Columbigallina minuta* (Linnaeus), Brazil.

P. recurvatus Eichler, 1949, from *Columbina picni* (Temminck), Paraguay.

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LARVAL PHANTOM MIDGES IN MISSOURI (Diptera: Chaoboridae)

WILBUR R. ENNS[1, 2]

Few collectors bring in adult phantom midges but the larvae are frequently taken in studies of larval taxonomy, mosquito surveys, aquatic entomology courses, and in studies involving fishes and their food. To meet a need in such studies; to stimulate additional study and collecting; and to contribute to a knowledge of the insects in Missouri, a survey was made of the larval collections of chaoborids which had accumulated in the entomology museum in the past few years. The present paper embodies the results of that survey. Additional impetus for the survey was provided by the appearance of the chaoborid paper by Cook (1956).

The survey revealed that three species occur in Missouri and hypothetically two more species may occur. Additional collecting, particularly in southeast Missouri, should establish the occurrence of the latter two species in the state. The following key, therefore, includes all five species representing two genera, one of which is further divided into two subgenera. One species, *Chaoborus (Chaoborus) americanus* (Johannsen) is reported for the first time from Missouri.

Although many of these species are readily reared from the larval to the adult stage, the larvae are perhaps more readily identifiable than the adults and it is certainly more expeditious to be able to identify the larvae at once than to have to rear them. The larvae are easily cleared and embedded on microslides so that all the salient characters are readily visible thus making identification comparatively simple. The technique is the same as that commonly employed for embedding mosquito larvae but care must be taken to get adequate separation of the appendages of the head. In our species there is no necessity for severing the caudal part of the body (except perhaps in *Corethrella*) because an entire lateral aspect shows all the essential parts.

In our species (except *Corethrella*) the most diagnostic morphological characters for separating the species are the paired prelabral leaflike appendages of the head (Figs. 4A; 5-9). They may vary somewhat in form (e.g., Figs. 5 and 6) but their proportionate maximum lengths to widths are constant enough to make them reliable key characters. In Figure 4 we have deliberately illustrated them as being partly obscured by the slender postantennal filaments. This is the appearance of the structures in a poorly made slide preparation. With a little judicious arranging of parts before the cover slip is applied, and exerting gentle pressure afterwards, all of the appendages can be made to assume a serial or linear arrangement, none being concealed by any other.

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[1] Department of Entomology, University of Missouri, Columbia, Missouri. Contribution from Missouri Agricultural Experiment Station, Project 36, Entomology Museum. Journal Series No. 2111. Approved by the Director.

[2] Mr. F. E. Wood, Graduate Student in Entomology, made the illustrations and grateful acknowledgment is made for his assistance.

Stone (1956) and Stone, Knight and Starke (1959) consider the phantom midges as a distinct family (Chaoboridae) rather than as a subfamily (Chaoborinae) of mosquitoes (Culicidae). Cook (1956) and Barr (1958) apparently do not agree with this although Cook's paper undoubtedly appeared before Stone's, and Barr only leaves an inference since he refers to all the mosquitoes as "Diptera:Culicidae:Culicinae." The present paper follows Stone, et. al., in considering phantom midges as a distinct family. Larval chaoborids are readily distinguished from mosquito larvae, at least in our species, by the absence of mouthbrushes and by the peculiar antennae which are fitted for grasping (Figs 4 and 10).

KEY TO THE GENERA OF CHAOBORIDAE IN MISSOURI

1. Paired hydrostatic organs present on thorax and seventh abdominal segment (Fig. 10); caudal respiratory siphon absent .... *Chaoborus* Lichtenstein
   Hydrostatic organs absent; caudal respiratory siphon present (Fig. 3) ..... *Corethrella* Coquillett

KEY TO THE SUBGENERA OF *Chaoborus* IN MISSOURI

1. Ninth abdominal segment with a dorsal, finger-like process (Fig. 2); antennae with a spine on anterior margin situated at less than half the distance from base to apex ..... *Sayomyia* Dyar & Shannon
   Ninth abdominal segment with at most only a slight protuberance dorsally (Fig. 10); antennae lacking anterior spine or, if present, at or distad of middle (Fig. 1) ..... *Chaoborus* Lichtenstein

KEY TO MISSOURI SPECIES OF *Sayomyia*

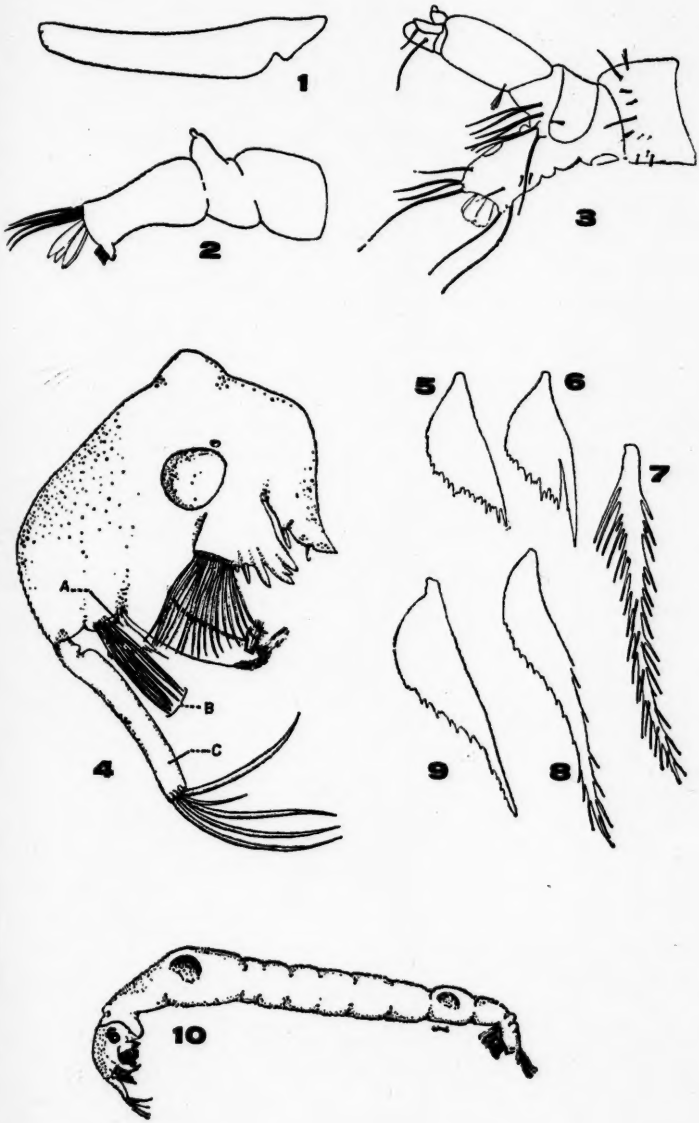
1. Prelabral leaflike appendages seven times or less longer than wide (Fig. 8) ..... *albatus* Johnson
   Prelabral appendages 15 or more times longer than wide (Fig. 7) ..... *punctipennis* (Say)

KEY TO MISSOURI SPECIES OF *Chaoborus* S. S.

1. Prelabral leaflike appendages less than two and one-half times longer than wide (Figs. 5 and 6) ..... *americanus* (Johannsen)
   Prelabral leaflike appendages at least four times longer than wide (Fig. 9) ..... *flavicans* (Meigen)

Explanation of Figures on Opposite Page

Fig. 1, antenna of *Chaoborus (C.) americanus* (Joh.). Fig. 2, caudal abdominal segments of *Chaoborus (S.) punctipennis (Say)*. Fig. 3, caudal segments of *Corethrella brakeleyi* (Coq.) (Redrawn from Cook). Fig. 4, head of *Chaoborus (C.) americanus* (Joh.). A, Prelabral leaflike appendages; B. Postantennal filaments; C. Antenna. Figs. 5 and 6, prelabral appendages of *Chaoborus (C.) americanus* (Joh.). Fig. 7, prelabral leaflike appendage of *Chaoborus (S.) punctipennis* (Say). Fig. 8, prelabral leaflike appendage of *Chaoborus (S.) albatus* Johnson (Redrawn from Cook). Fig. 9, prelabral leaflike appendage of *Chaoborus (C.) flavicans* (Meigan). Fig. 10, *Chaoborus (C.) americanus* (Joh.), entire larva.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C. brakeleyi (Coquillett) has been recorded from Reelfoot Lake, Tennessee, and should occur at least in southeast Missouri.

ANNOTATIONS

Chaoborus (Chaoborus) americanus (Johannsen). This appears to be the most commonly collected species in farm ponds and small lakes, at least in central Missouri. As mentioned previously, this is believed to be the first published record of its occurrence in the state. Collection dates range from November 3 to May 6. Locality records include Boone County (Ashland, Columbia, Huntsdale); Cooper County (Boonville); Howard County (Boonesboro); and Wayne County (Piedmont).

Chaoborus (Chaoborus) flavicans (Meigan). Cook (1956) records this species from St. Louis, May 12. We have one additional record from Boone County (Hallsville, April 27, 1957, F. E. St. Aubin, in farm pond).

Chaoborus (Sayomyia) punctipennis (Say). In the literature, this species is recorded from St. Louis and Parkville (Platte County), May 25-29, by Cook (1956). Additional records in our collections include Barry County (Shell Knob; White River, at depths of 8 feet and 9 feet); Clinton County (Plattsburg); Shelby County (Lake Hunnewell at a depth of 4-5 feet); and Taney County (Lake Taneycomo at depths of 28 feet and 32 feet; Bull Creek at depths of 26 feet and 27 feet). Collection dates run from July 13 to April 20.

Chaoborus (Sayomyia) albatus Johnson. Although we have no records of this species in the state at present, it is recorded (Cook, 1956) from Illinois and Tennessee and may possibly occur in southeast Missouri.

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